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determinants, from 1846 to 1879," 94–122; IV: "Symmetric determinants that are not axisymmetric, from 1862 to 1879," 123–131; V: "Alternants from 1860 to 1879," 132–175; VI: "Compound determinants from 1862 to 1880," 176–207; VII: "Recurrents from 1858 to 1879," 208–247; VIII: "Wronskians from 1862 to 1874," 248-256; IX: "Jacobians from 1862 to 1877," 257–271; X: "Skew determinants and Pfaffians from 1862 to 1880," 272–283; XI: "Orthogonants from 1855 to 1879, 284–308; XII: "Persymmetric determinants from 1836 to 1879," 309-326; XIII: "Bigradients from 1859 to 1880," 327–362; XIV: "Hessians, from 1862 to 1879," 363–371; XV: "Circulants, from 1861 to 1880," 372–392; XVI: "Continuants from 1850 to 1880," 393–422; XVII: "Multilineants up to 1877," 423–428; XVIII: "Cubic and n-dimensional determinants up to 1880," 429–431; XIX: "Bordered determinants up to 1880," 432–446; XX: "Determinants whose elements are combinatory numbers up to 1880," 447–462; XXI: "Zero-axial determinants up to 1888," 463–468; XXII: "The less common special forms from 1839 to 1880," 469-496; "List of authors," 497-503.

R. C. ARCHIBALD.

College Teaching. Studies in Methods of Teaching in the College. Edited by PAUL KLAPPER with an Introduction by N. M. Butler. Yonkers-on-Hudson, New York, World Book Co., 1920. 16 + 583 pp.

This book contains twenty-eight chapters by as many different authors. Chapter VIII (pages 161–182) on "The Teaching of Mathematics" is by G. A. MILLER. The sub-headings of the chapter are as follows: Recent changes and some of their sources; Influence of researches in mathematics on methods of teaching; Range of subjects and preparation of students; Variety of college courses in mathematics; History of college mathematics; Relation of mathematics in secondary school and college; Aims of college mathematics: methods of teaching; Advanced work in college mathematics; Mathematics and technical education; Preparation of the college teacher of mathematics; The mathematical text-book.

The Teaching of Arithmetic. By JOHN C. STONE. Chicago, Benj. H. Sanborn & Company, 1918. 262 pp. Price $1.32.

This presents for teachers, supervisors, and those preparing to teach, "a discussion of the aims and purposes of a course in arithmetic and of the methods of presenting each topic that should find a place in our elementary schools." The final chapter, on "Measuring results," gives an account of the standard arithmetic tests developed during the last twenty years.

NOTES.

In T. ZIEHEN, *Lehrbuch der Logik auf positivistischer Grundlage mit Berücksichtigung der Geschichte der Logik,* (Bonn, A. Marucs & E. Webers Verlag, 1920), are discussed: "Die mathematische (symbolistische) Logik" pp. 227–236 including a bibliography of about 35 authors; "Mathematische Grundlegung der Logik," pp. 410–416.

A new list of the members of the Mathematical Association (England) was published in April, 1920. It contains the names of 9 "honorary members," of 747 "ordinary members", and of 83 "associates" of the London, Yorkshire, North Wales, and Sydney (New South Wales) Branches.

Librarians should not be confused by the fact that the last year (October, 1919–September, 1920) of *Revue de Mathématiques Spéciales* is marked "30e année." While the first year of publication was 1890–91, there was no issue between September, 1914 and October, 1919. As the publisher (Vuibert, Paris) acknowledges: "Les 25e, 26e, 27e, 28e, 29e années manquent donc à la collection."

The sixth quarto volume of the sumptuous edition of *Tychonis Brahe Dani Opera Omnia,* now being issued under the auspices of the Danish Society of Language and Literature (Danske Sprog- og Litteratur-Selskab), was published just a year ago. The editor, J. L. E. DREYER, who edited also *The Scientific Papers of Sir William Herschel* (1912), was director of the Observatory at Armagh, Ireland, 1882–1916.

A marble monument to Tartaglia (1499?–1557) was unveiled at Brescia, his birthplace, on November 10, 1918. "L'Ateneo" of Brescia published an "elegante opuscolo, riccamente illustrato," entitled *Scoprendosi il Monumento a Nicolò Tartaglia,* and containing short articles by seven different authors. Among them are: "L. da Vinci e N. Tartaglia" by A. Favaro; "Nicolò Tartaglia e l'arte della guerra" by G. Loria.

The following publications have appeared during the past four months: *Archimedes* (Pioneers of Progress Series), by T. L. HEATH (London, S.P.C.K. Price 2 s.); *Some Famous Problems of the Theory of Numbers and in particular Waring's Problem. An inaugural lecture delivered before the University of Oxford,* by G. H. HARDY (Oxford, Clarendon Press. Price 1 s. 6 d.); *An Introduction to String Figures. A new Amusement for Everybody,* by W. W. ROUSE BALL (Cambridge, W. Heffer and Sons. Price 2 s.); *An Introduction to Combinatory Analysis,* by P. A. MACMAHON (Cambridge University Press. Price 7 s. 6 d.); *Teachers' Manual, Second Course in Algebra,* by W. B. FORD and C. AMMERMAN (New York, Macmillan. 5 + 247 pages. Price $1.20); *Elementary Functions and Applications,* by A. S. GALE and C. W. WATKEYS (New York, Henry Holt and Co. 20 + 436 pages. Price $2.60).

There is much current discussion of "research." The address delivered on November 8, 1919, by Professor J. C. FIELDS, of the University of Toronto, as president of the Royal Canadian Institute, has been recently issued in pamphlet form (27 pages). It is entitled "Universities, research and brain waste."—In the *Scientific Monthly,* July, 1920, Dr. J. R. ANGELL deals with the conception of research, the distribution of research functions, personnel, training research men, organization and cooperation in research, and organization of the National Research Council, in "The organization of research."—A recent address on "The college teacher and research," by Professor LeRoy D. WELD, of Coe College, was published in *Science* for July 16, 1920.—Professor Paul APPELL in an interview (*Temps,* May 22, 1920) defined instruction in the secondary schools and universities: "le premier, c'est là, où *on apprend à apprendre,* le second, c'est celui où *on apprend à chercher.*"

The Government Printing Office, Washington, D. C., has only recently distributed to libraries: *Aeronautics, Third Annual Report of the National Advisory Committee for Aeronautics 1917*, which was published in 1918. It is a volume of nearly five hundred royal octavo pages and many plates, and contains twenty-three reports. Report 21, "Theory of an airplane encountering gusts, II" by Professor E. B. Wilson, of Massachusetts Institute of Technology, occupies pages 403–431, and is in continuation of his report published in the first annual report of the Committee.

"In speaking of *time* as a fourth dimension to space, have not our mathematicians been guilty of a carelessness in language which they would be the last to tolerate in symbols? They are always careful to associate (x, y, z) not with t but with ct, where c is the velocity of light. The fourth dimension is not *time* at all, but *distance travelled*, otherwise these same mathematicians would say its dimensions were wrong. Or if it is preferred to use time, then we must divide (x, y, z) by c, which comes to measuring distances in light-years before we can associate them with time.

"A further protest against the rather unnecessary mystification of the layman may not carry quite so much weight; but all the same let it be made. Is it vital to use imaginary time in our language and our thoughts? As a piece of mathematical mechanism it may be useful to treat a hyperbola $x^2 - y^2 = 1$, as a particular case of a circle $x^2 + y^2 = 1$; but it is surely straining our powers of conception needlessly to talk of the hyperbola as a particular case of the circle, except for the purpose of obtaining results quickly by the methods of projective geometry. The 'rigid body rotation' invoked for the transformation of $dx^2 + dy^2 + dz^2 - c^2dt^2$ calls up a false image in some of our minds: it is really a simple distortion with which we have to do, and could not this be mentioned in a cautionary way?"—From *The Observatory*, April, 1920, volume 43, page 171.

ARTICLES IN CURRENT PERIODICALS.

American Journal of Science, volume 49, May, 1920: "The mathematics of isostasy" I by I. C. Chamberlain, 311–318, II by W. D. MacMillan, 318–323.

Journal of the Indian Mathematical Society, volume 11, no. 6, December, 1919 (published May, 1920): "International Congress of Mathematicians," 201–202; "Computation of the ephemeris of a planet and a comet" by R. N. Apte, 203–218; "An extension of Feuerbach's theorem" by M. Bhimasena Rao, 219–227; "To find a cube the sum of whose divisors is a perfect square" by N. B. Mitra, 228–229; Note on a continued fraction by K. B. Madhava, 230–234; "Astronomical notes," 235–236; Problems and solutions, 237–240.

Journal of the Washington Academy of Sciences, volume 10, no. 2, Jan. 19, 1920: "A trigonometric computer" by F. E. Wright, 29–31.—No. 7, April 4: "A graphical method for plotting reciprocals" by F. E. Wright, 185–188.

Mathematical Gazette, volume 10, May, 1920: "The graphical treatment of differential equations" (continued) by S. Brodetsky, 49–60; "Ratio and proportion" by D. K. Picken, 60–62; "Gleanings from far and near," 62, 74; "Geocentric parallax" by A. A. Krishnaswami Aiyangar, 63–64; "A graphical treatment of simple harmonic motion" by W. G. Bickley, 64–65; "A trigonometrical lucubration" by R. F. Muirhead, 66–68; "Some incidental writings by De Morgan" (continued), 69–74; Review by J. M. Child of W. N. Rose's *Mathematics for Engineers* (London, 1920), 75–76; Review by A. Dakin of C. de la Vallée Poussin's *Leçons sur l'approximation des fonctions d'une variable réelle* (Paris, 1919), 76–77; Review by G. H. Hardy of Petrovitch's *Les spectres numériques* (Paris, 1919), and J. L. S. Hatton's *Theory of the Imaginary in Geometry*, 77–79; "Books received, contents of journals, etc.," i–iv.

Messenger of Mathematics, volume 49, no. 5, September, 1919: "On some series whose nth term involves the number of classes of binary quadratics of determinant $-n$" by L. J. Mordell, 65–72; "A note on a theorem of Riemann's" by Grace C. Young, 73–78; "The twelve elliptic functions related to sixteen doubly periodic functions of the second kind" by E. T. Bell, 78–80—October: "The twelve elliptic functions related to sixteen doubly periodic functions of the second kind" (concluded) by E. T. Bell, 82–84; "Notes on some points in the integral calculus (lii)" by G. H. Hardy, 85–90; "A new integral equation satisfied by the solution of a certain linear differential equation, which occurs in the theory of electrical oscillations and of the tides" by E. G. C. Poole, 91–96.